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Adherence of patients to long-term medication: a cross-sectional study of antihypertensive regimens in Austria

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Summary
Objective The objective of this study was to evaluate adherence and causes for non-adherence to antihypertensive therapy in Austrian patients. A special focus was placed on social parameters and behavioural theories.

Methods Patients were invited via advertisements in community pharmacies in Austria to complete an online survey. Inclusion criteria were an age of 18 years or older, a diagnosis of arterial hypertension and a current prescription of antihypertensive medication. Adherence was measured by the four-item Morisky scale. Non-adherence was defined by at least one point in the Morisky scale. Several demographic, social and behavioural parameters were analysed as potential co-variables associated with adherence.

Results A total of 323 patients completed the online survey, of which 109 (33.7 %) met the criteria for non-adherence. In a multivariable model, self-efficacy and age were associated with adherence, whereas intention and barriers were linked to non-adherence; 56 patients (17.3 %) were classified as intentionally non-adherent.

Conclusion This study demonstrates that non-adherence affects an important proportion of patients in the treatment of arterial hypertension. Young age was a particularly important risk factor for non-adherence, and this patient population is, therefore, in need of special attention. Modifiable risk factors were identified that could help improving the treatment of arterial hypertension and potentially other chronic conditions.

Keywords Adherence · Arterial hypertension · Medication

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Introduction

Over the past decades, important progress in medical and pharmaceutical sciences led to the development of new efficacious treatments for diverse chronic conditions. However, the ultimate impact of any drug treatment—often measured as the effectiveness—also depends on the patients' adherence to it. Treatments with high efficacy in clinical trials may turn out to be only moderately effective due to incomplete medication adherence with recommended dosing regimens in real-world settings. Non-adherence was therefore identified as a major public health problem by constituting a barrier to the effective, safe and cost-effective use of drugs [1]. Conclusively, the World Health Organization (WHO) reported non-adherence as a worldwide medical problem associated with excess morbidity, mortality and unnecessary costs [2]. WHO defined adherence 'as the extent to which a person's behaviour—taking medication, following a diet and/or executing lifestyle changes—corresponds with agreed recommendations from a health care provider' [2]. Taking this further, Vrijens et al. [3] recently introduced a new taxonomy for describing and defining adherence to medication. It was proposed to uniformly use the term 'medication adherence', which was defined as 'the process by which patients take their medications as prescribed, composed of initiation, implementation and discontinuation'. In accordance with this new taxonomy, the term 'medication adherence' will be used throughout this manuscript. In arterial hypertension—defined as a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher—lack of medication-adherence to prescribed medicines is a major reason for unsatisfying therapeutic outcomes and therefore a major challenge [4]. Similar to other chronic conditions, including diabetes and overweight, a main reason for problems in patients' adherence is the asymptomatic nature of the disease. Other previously reported factors contributing to non-adherence include the long-term disease course of hypertension and thus the necessity for lifelong treatment and multiple daily dosing [5, 6].

Improving the adherence to therapeutic regimens could substantially improve therapeutic outcomes, especially in high-income countries, where effective drugs are widely available for everybody. It may prove most cost effective to increase the effectiveness of already licensed drugs by improving medication adherence rather than focussing on developing further new therapeutic products. A better understanding of causes of non-adherence is, however, necessary to ultimately improve effectiveness of current drugs. Thus, the aim of this study was to evaluate adherence to long-term medication in Austria and determine its causes, with a special focus on social parameters and behavioural theories.

Methods

Data presented in this article stem from the European Union (EU) funded project 'Ascertaining Barriers for Compliance: policies for safe, effective and cost-effective use of medicines in Europe' (ABC). Cumulative data for the entire European cohort were published in June 2012 in the Final Study Report of the ABC Project and in 'Value in Health' (in press). This manuscript describes in detail findings of this survey restricted to Austria.

Patients were recruited via advertisements (posters and printed material) in community pharmacies across Austria, which were randomly selected from a list provided by the national prescription pricing authority. A total of 1272 pharmacies were contacted. Patients were eligible if they were 18 years of age or older, had a diagnosis of arterial hypertension, were currently prescribed medication against arterial hypertension and were self-responsible for drug administration. Exclusion criteria were lack of consent, presence of a self-reported psychiatric condition and living in a nursing home or similar facility. The questionnaire was completed via a web-based survey tool provided by SurveyMonkey.com.

Measuring adherence

In this study, adherence was measured by the four-item Morisky Medication Adherence Scale (MMAS-4). The MMAS-4 is the most frequently used questionnaire measuring adherence to medication [7]. This scale, originally designed to evaluate medication adherence in hypertensive patients, has been validated and found to be reliable in a variety of medication adherence studies [8].

Patients were categorized as non-adherent if they answered one or more question of the MMAS-4 with 'yes'. They were classified as intentionally non-adherent when either item 3 or 4 or both were answered with 'yes' (see also Table 1). Items 1 and 2 of the MMAS-4 (i.e. 'Do you ever forget to take your high blood pressure medicine?' and 'Do you ever have problems remembering to take your blood pressure medicine?') are related to the implementation of the dosing regimen and are more non-intentional whereas items 3 and 4 (i.e. 'When you feel better, do you sometimes stop taking your high blood pressure medicine?' and 'Sometimes, if you feel worse when you take your blood pressure medicine, do you stop taking it?') are related to treatment discontinuation and are intentional.

Measurement of variables and instruments used

The Stanford Self-Rated Health Scale was used to measure health status; the Revised Life Orientation Test was used to determine dispositional optimism [9]; the Beliefs about Medicines Questionnaire (BMQ-S11) was applied to evaluate beliefs about medicine [10]; and to measure attitudes, normative beliefs, barriers, facilitators, inten-

Table 1 Demographic data and missing data for overall study population ($n = 323$)

Variable (% missing data)	Median (25th–75th percentile) or absolute numbers (% of overall population)
Age (0 %)	62 years (51–69 years)
Sex (0 %)	
Male	178 (55.1 %)
Female	145 (44.9 %)
Civil Status (2.2 %)	
Married	209 (64.7 %)
Single/divorced/widow	107 (33.1 %)
Education (2.8 %)	
Primary/secondary	120 (37.2 %)
Higher than primary/secondary	194 (60.1 %)
Employment (1.5 %)	
Working/student	119 (36.8 %)
Retired/unemployed	199 (61.6 %)
Number of medical conditions, median (1.2 %)	2 (1–3)
Number of medicines, median (1.2 %)	4 (2–6)
Number of tablets per day, median (2.8 %)	4 (2–7)
Dosage frequency (0.9 %)	
Once daily	114 (35.3 %)
Two times daily	110 (34.1 %)
Three times daily	96 (29.7 %)
More than three times daily	0 (0 %)
Self reported health status (0.6 %)	
Poor	23 (7.1 %)
Fair	96 (29.7 %)
Good	128 (39.6 %)
Very good/excellent	74 (22.9 %)
Number of items on last prescription, median (8.7 %)	4 (2–6)
Do you pay for prescription (0.9 %)	
No	26 (8.0 %)
Yes, prescription charge	282 (87.3 %)
Yes, full cost	12 (3.7 %)
Affordability problem (0.9 %)	
No	231 (71.5 %)
Yes	89 (27.6 %)
Use of cost coping strategies, mean (3.1 %)	0.9585
Optimism—life orientation test (0 = low, 24 = high; 9.0 %)	15 (13–18)
Necessities of medicines (5 = low, 25 = high; 8.6 %)	19 (16.75–22)
Concerns about medicines (6 = low, 30 = high; 10.8 %)	15 (12–19)
Attitudes—theory of planned behaviour (7 = low, 35 = high; 12.3 %)	28 (25–32)
Normative beliefs—theory of planned behaviour (3 = low, 15 = high; 12.3 %)	15 (12–15)
Barriers—theory of planned behaviour (1 = low, 5 = high; 10.2 %)	1 (1–3.75)
Facilitators—theory of planned behaviour (3 = low, 15 = high; 13.6 %)	8 (5–11)
Intention—theory of planned behaviour (2 = low, 10 = high; 10.2 %)	10 (9–10)
Self efficacy—theory of planned behaviour (2 = low, 10 = high; 7.4 %)	8 (6–10)
Practitioner (7.4 %)	
General practitioner/family physician	163 (50.5 %)
Other	136 (42.1 %)
Gender of practitioner (10.2 %)	
Female	114 (35.3 %)
Male	176 (54.5 %)
EUROPEP satisfaction with practitioner (17 = low, 85 = high; 18.9 %)	70 (62–79)
EUROPEP satisfaction with practice (6 = low, 30 = high; 16.1 %)	24 (21–29)
BRIGHT barriers (0 = low, 60 = high; 45.8 %)	5 (1–8.5)
BRIGHT social support (0 = low, 28 = high; 13.0 %)	2 (0–4)
BIPQ	
Illness consequences (8.0 %)	5 (2–8)
Illness timeline (8.7 %)	10 (8–10)
Personal control (8.0 %)	7 (4–8)
Treatment control (9.0 %)	9 (7–10)
Identity (9.6 %)	5 (2.75–7)
Concern about illness (9.3 %)	5 (3–8)
Illness coherence (10.8 %)	8 (6–10)
Emotional representations (9.6 %)	4 (2–6)
Income (11.5 %)	
Salaries/wages	93 (28.8 %)
Pensions/benefits/others	193 (59.8 %)
Total Income (deciles; 9.0 %)	
1–4	96 (29.7 %)
5–7	103 (31.9 %)
8–10	57 (17.6 %)
Not willing to provide	38 (11.8 %)
Income perception (8.0 %)	
Comfortable	65 (20.1 %)
Coping	141 (43.7 %)
Difficult/very difficult	54 (16.7 %)
Not willing to provide	37 (11.5 %)
Ease of borrowing (8.7 %)	
Very difficult, quite difficult	122 (37.8 %)
Neither easy nor difficult	85 (26.3 %)
Quite easy, very easy	38 (11.8 %)
Not willing to provide	50 (15.5 %)

EUROPEP European Task Force on Patient Evaluation in General Practice questionnaire, *BRIGHT* Building Research Initiative Group: Chronic Illness Management and Adherence in Transplantation, *BIPQ* Brief Illness Perception Questionnaire

tion and self-efficacy, a theory of planned behaviour (TPB) questionnaire was used. TPB is a theory in psychology about the link between beliefs and behaviour [11]. A questionnaire of the European Task Force on Patient Evaluation in General Practice was used to measure satisfaction with the practitioner and her/his practice [12]; the Building Research Initiative Group: Chronic Illness Management and Adherence in Transplantation (BRIGHT) was used for barriers and social support [13, 14]; and the Brief Illness Perception Questionnaire (BIPQ) was applied to assess parameters of illness perception [15].

Ethical considerations

Ethical approval was obtained by the national ethics committee in Austria (590/2011). Participants provided informed consent by checking a box in the online survey to confirm that they had read and understood all participant information. Access to the survey was denied if the box was not checked. SurveyMonkey®, where the questionnaire responses were stored initially, guaranteed data safety. SurveyMonkey® has signed up to the Safe Harbor agreement. This agreement was created to enable the transfer of 'personal data' between the EU and USA following the introduction of the EU's Data Protection Directive (1995). SurveyMonkey® was asked in written to completely delete survey data from its servers after the termination of the survey.

Data analysis

The primary outcome of this study was the estimation of the percentage of non-adherent patients defined as patients having answered 'yes' to at least one of the four items of the Morisky questionnaire. For binominal variables, a Fisher's test was applied to calculate differences in distribution between adherent and non-adherent patients. For continuous variables, a Mann–Whitney test was computed. Binary logistic regression analysis was performed to compute a multivariate model including parameters with a significant difference in distribution between adherent and non-adherent patients. Complete case analysis was used. Normal approximation of the binomial distribution was used to derive 95 % confidence intervals. Statistical analysis was performed with 'R', version 3.0.2.

Results

A total of 323 participants completed the questionnaire; 178 (55.1 %) were men and 145 (44.9 %) women. Median age was 62 years (25th–75th percentile: 51–69 years; range: 25–89 years). For more demographic data, see Table 1.

In the overall study population, 109 (33.7 %) participants had a Morisky score of 1 or more and were therefore classified as non-adherent; 56 patients (17.3 %) were classified as intentionally non-adherent. In detail, 84 (26.0 %) participants answered item 1 of the MMAS-4 with yes, 33 (10.2 %) item 2, 40 (12.4 %) item 3 and 33 (10.2 %) participants item 4.

Table 2 Multivariable model investigating association between various variables and non-adherence

Variable	OR	95 % CI	*p*-Value
Age	0.94	0.89–0.99	*0.022*
Number of medicines	0.93	0.67–1.25	0.622
Number of tablets per day	1.00	0.85–1.13	0.983
Employment status	1.96	0.56–7.32	0.299
Number of medical conditions	0.96	0.64–1.37	0.829
Use of coping strategies	0.95	0.77–1.14	0.619
Necessities (BMQ)	0.92	0.79–1.07	0.303
Attitudes (TPB)	0.97	0.88–1.08	0.620
Normative believes (TPB)	0.94	0.79–1.11	0.458
Self efficacy (TPB)	0.66	0.52–0.83	*< 0.001*
Intention (TPB)	1.44	1.04–2.16	0.044
Illness consequences (BIPQ1)	0.91	0.77–1.08	0.282
Illness timeline (BIPQ2)	0.95	0.74–1.21	0.661
Personal control (BIPQ3)	0.99	0.82–1.19	0.897
Treatment control (BIPQ4)	1.08	0.80–1.46	0.614
Illness coherence (BIPQ7)	0.92	0.75–1.12	0.395
Satisfaction of practitioner	1.03	0.97–1.09	0.399
Satisfaction with practice	1.05	0.91–1.22	0.486
Barriers (BRIGHT)	1.12	1.02–1.23	*0.025*

BMQ Beliefs about Medicines Questionnaire, *TPB* theory of planned behaviour questionnaire, *BRIGHT* Building Research Initiative Group: Chronic Illness Management and Adherence in Transplantation, *BIPQ* Brief Illness Perception Questionnaire, *OR* odds ratio, *CI* confidence interval

Factors influencing non-adherence

In univariate analysis, young age was associated with non-adherence. The rate of non-adherence was also significantly higher in working patients or students compared with retired or unemployed ones. Conversely, adherent patients were prescribed a higher number of different drugs ($p = 0.001$), tablets per day ($p = 0.008$) and had more items on the last prescription ($p = 0.028$).

Patients classified as adherent had a high score in the perceived necessity section of the Beliefs About Medicine Questionnaire, the attitude, normative beliefs, intention and self efficacy section of the Theory of Planned Behaviour Questionnaire and the perceived illness consequences, illness timeline, personal control, treatment control and illness coherence part of the BIPQ. Satisfaction with the treating practitioner and his practice were significantly higher in adherent patients. In contrast, the use of cost coping strategies and a high score in the perceived barriers section of the BRIGHT questionnaire were associated with non-adherence.

In a multivariable model, older age (odds ratio (OR): 0.94, 95 % confidence interval (CI): 0.89–0.99; $p=0.02$) and self-efficacy (i.e. the personal sense of control; TPB); OR: 0.66, 95 % CI: 0.52–0.83; $p<0.001$) were associated with adherence, whereas intention (TPB; OR: 1.44, 95 % CI: 1.04–2.16; $p=0.04$) and perceived barriers (BRIGHT; OR: 1.11, 95 % CI: 1.02–1.23; $p=0.02$) were linked to non-adherence (see Table 2).

Intentional non-adherence

Intentional non-adherence was significantly more frequent in participants reporting regular employment or students than in retired or unemployed (15.0 vs. 33.7 %; $p=0.01$). Use of cost coping strategies was associated with intentional non-adherence (Mann–Whitney *U*: $p=0.048$). Scores in the variables attitudes, intention, self-efficacy and normative believes (TPB) and illness timeline and treatment control (BIPQ) were lower in patients classified as intentionally non-adherent. Also, a high score in perceived barriers (BRIGHT) was significantly associated with intentional non-adherence. Due to the small case numbers, multivariable analysis was omitted.

Discussion

Non-adherence to antihypertensive medication was 33.7 % in our patient population. These data therefore demonstrate a clear need for improvement of patient care even in high-income countries, where universal access to healthcare is guaranteed. The observed proportion is considerably higher than for other medical conditions with a more symptomatic disease course including multiple sclerosis or follow-on therapy after acute coronary syndrome [16, 17]. However, other European countries had considerably higher proportions of non-adherence, for example, accounting for up to 70 % of patients in Hungary [18].

In our multivariable analysis, we identified four risk factors significantly influencing the adherence to antihypertensive medication.

Young age was shown to be associated with non-adherence. Although this is a non-modifiable factor, young patients may require specially tailored information or advice to improve adherence. This may be of particular importance because young patients are most likely to benefit from improved adherence to antihypertensive drugs, in that they can decrease the cardiovascular risk of a long-term hypertensive disease.

Among the modifiable risk factors low self-efficacy (TPB), high intention (TPB) and high perceived barriers to medication adherence (BRIGHT) were identified as predictors for non-adherence. Self-efficacy is the personal sense of behavioural control, and its crucial importance in several different settings was shown previously [19–21]. People who believe that they have the ability to behave in the manner necessary to solve a problem become more inclined to do so and feel more committed to their decisions and behaviours [22]. Self efficacy can be influenced by a person's own experience, the experiences of others, social persuasion and by their psychological status [23]. Also, barriers including perceived or actual side effects of drugs or forgetfulness should be specifically addressed in all patients with hypertension to optimize therapeutic outcomes. This also shows that personal beliefs and social influences are more important for adherence than the clinical situation or factors attributable to the disease itself. Paradoxically, we also found high behavioural intention to be associated to non-adherence. This finding stands in contrast to literature [24], and we speculate that it might be an artefact of statistical analyses, especially because intention was already very high in the overall study population (median 10 out of 10 points).

Our results also show the crucial role of allowing enough time in personal communications between the practitioner and patients to make interventions possible and successful. Such risk factors can be influenced by a range of interventions. Self-efficacy might be increased by programs such as the herz.leben program, which was established in Styria, Austria. This programme provides structured training for patients on several aspects of the treatment and control of the disease (e.g. adequate nutrition, physical exercise, blood measurement training) and was shown to significantly decrease blood pressure and the risk of a cardiovascular event [25].

Limitations of this study included the way of data acquisition possibly leading to a selection bias in the study population. Questionnaires and responses were provided via Internet leading to the impossibility to confirm diagnoses or responses. Importantly, patient groups without Internet access were most likely underrepresented in this survey. The so-called self-serving bias, defined as the distortion of cognition of perception to maintain self-esteem, might have confounded our results, and the impact of non-responders was not assessable during this survey. However, the anonymity of this survey may also be regarded as strength, as responders are less likely to conceal non-adherence compared with personal interviews.

In summary, this study reports a high proportion of non-adherence to antihypertensive medication in Austria, but identifies modifiable variables influencing adherence. This survey may provide important insights for the treatment of arterial hypertension and other chronic conditions. Future studies should evaluate specific interventions to improve adherence to therapeutic regimens. This could help to ameliorate effectiveness and efficiency of existing drugs.

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Conflict of interest

The authors declare that they have no conflict of interest.

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